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RESEARCH ABSTRACTS 75/76-2 .

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M.G.B. Weedon

EDITOR'S SUMMARY

↳ The Swedish Research Institute for National Defence issues a quarterly list of unclassified Reports published by the Institute. The titles of these Reports and informative abstracts have been translated in English. This volume is the second issue of 1975/76. Further volumes will be translated in due course. The main topics covered are: Protection - atomic, biological, chemical; ammunition and weapons; conduct of war, information and commands; vehicles and spacecraft; reliability and logistics; human factors; associated studies and their solutions; positive methods for limitation and control of armaments; psychology reports.

EDITOR'S NOTE

→ The Reports are in Swedish unless some other language is indicated (usually English). When requesting Reports it should be appreciated that an English version will not normally be available, and that the prices of the original Swedish documents have not been indicated in this Translation. Reports may be obtained from:

FOA P Rapportredaktion, 104 50 Stockholm 80, Sweden

310 450
LB

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The report describes the types of neutron and gamma transfer problems dealt with by FOA, together with the methods of calculation used. In the analysis of the outcome of a nuclear explosion which is closely allied to the neutron and gamma radiation, problems arise which lead to calculations of criticality, leakage and of total transmission. The considerable calculating capacity which exists in FOA has also made it possible to solve other problems in particle transfer both within and outside FOA. These types of problems are reviewed here. The report has an appendix giving a comparison and brief descriptions of all the transfer problems at present in production at FOA.

A3 The effect of nuclear explosions

(57) FOA report B30002-A3

Properties of surface states in silicon investigated in MSM structures
(in English)

B. Sigfridsson and J. Lindström

October 1974

Extract from Proc. 5th Conf. Solid State Devices, pp.295-300, Tokio 1973

FOA reprint 1974/75:9

The surface state in P- and N-silicon ($10k\Omega\text{ cm}$) has been examined by means of a method where light pulses falling on a transparent contact on the silicon slice give rise to minority carrier current pulses suitable for the exploration of fields and the properties of contacts. By measuring the lifetime of the minority carrier at the contacts at different temperatures we found acceptor type surface states in N-silicon at $(E_c - 0.4)\text{eV}$ and donator type surface state in P-silicon at $(E_v + 0.43)\text{eV}$. Both levels could also be shown by photo-conductive measurements, which supports the above results that minority carriers recombine via $(E_c - 0.41)\text{eV}$ in N-type and via $(E_v + 0.43)\text{eV}$ in p-type. We accordingly found that the effect of the surface state on the recombination process was strongly dependent on the field, particularly in silicon of P-type.

(58) FOA report B30003-A3

On the determination of the photo-ionization energy and the concentration of defects created by nuclear radiation in silicon diodes (in English)

H. Hakansson and others

April 1975

The report gives the measurements of damage caused to silicon diodes by neutron and gamma irradiation. The photo-ionization energy and yield have been determined for the damage by means of optical methods. Changes in the diodes' characteristics have been investigated and comparisons made between different types of diodes.

(59) FOA report C40024-A3

Iodine ^{131}I in thyroid glands of South Swedish cattle and sheep during September and October 1974

K. Lidén and others

October 1975

In September 1974, ^{131}I was detected in the thyroid glands of cattle and sheep which had grazed on different areas in South Sweden. The concentrations measured during the period September 9 to 13 was $0.2\text{--}0.5\text{ pCi g}^{-1}$ of ^{131}I in the animals' thyroid glands. Based on these results it is estimated that ^{131}I deposition during the same period was $0.5\text{--}1\text{ pCi m}^{-2}$. So small an addition of ^{131}I to the biosphere is very difficult to detect by any other method of measurement. Agreement between the estimated amount of ^{131}I deposited in the thyroid gland and the amount measured was good, assuming the estimate was based on measurements of ^{95}Zr and ^{140}Ba in rainfall and ground level air. ^{131}I

contamination of the South Swedish cattle and sheep is probably due to the nuclear explosion carried out in the atmosphere over China on 17 June 1974.

A4 Protection against atomic warfare

(60) FOA report C20076-A4

Technical material nuclear warhead protection

B. Engström and others

November 1975

Vulnerability of materials and systems to the effects of nuclear warheads can be reduced by a sequence of different proceedings. As an example, the material or system can be individually protected or placed in protecting fortifications. On the other hand, where units can be dispersed or arranged to be portable, camouflage or decoys can also be used. The report deals with the former procedure viz individual protection, and is mainly applicable to personnel who work with the technical arrangement of material and system (constructors, mostly from the Military, and personnel responsible for safe custody of material and systems).

The descriptions for reducing vulnerability is given in the form of working procedures. A clearly arranged picture gives the relative significance of the forms of effects for different sizes of warhead and for different objects. The section on the effects of radiation and EMP is more comprehensive for different reasons, than the section on the remaining forms of effects. For different types of material the vulnerability and countermeasures are exemplified as far as possible by individual protection. The report is the first of its kind and is a preliminary work which does not claim to cover the whole subject.

The demand for reasonable costs and the maintenance of primary functions in the material in a conventional war, underlines the necessity in the case of nuclear weapons, for a methodical application of individual protection and other vulnerability-reducing procedures. These methods and questions of adjustments are not dealt with in this report.

B PROTECTION - BIOLOGICAL

B1 Consideration and appraisal of biological threats. Forecasts and summaries

See reference (63)

B4 Indication and identification

(61) FOA report B40027-B4

Analytical information obtainable by evaluation of the time course of firefly bioluminescence in the assay of ATP (in English)

A. Lundin and A. Thore

July 1975

Extract from Anal. Biochem. Vol.66, pp.47-63, 1975

FOA reprint 1975/76:5

Methods and equipment have been developed for the indication of biological warfare material from the analysis of small amounts of ATP by the use of firefly luminescence. Sources of error in the analysis have been studied, especially as regards the effect of different methods of evaluation of the ATP induced bioluminescence. In this case measurements of the earliest phases of bioluminescence appeared to give more reliable analytical results. This particularly validates a method not previously described for evaluating the bioluminescence, namely by measuring the rate of the initial rise in the light emission. Different ways of minimising analytical disturbances are discussed. Commercial and purified reagents have been used and their analytical properties evaluated. A computer based method to improve exploitation of information obtainable from the bioluminescence time cycle, is outlined.

(62) FOA report B40035-B4

Quantification of the inhibitory effect of eriochrome black and sodium nitrite on non-specific immunofluorescent staining (in English)

E.A. Karlsson and others

November 1975

Acta path. microbiol. scand. Sect. B, 83, pp.482-490, 1975

Non-specific fixation of fluorescent stained antibodies in tissue cells and debris often causes problems in the interpretation of the immuno-fluorescence. A model system has been developed for evaluating non-specific colouring of animal tissue with FITC stained immunoglobulins. Whole cells are treated with stained antisalmonella globulin and the cell's fluorescence intensity is determined quantitatively by an optical fibre sensor system. The system is used to determine the optimal treatment conditions (concentrations, treatment time) when using eriochrome black and sodium nitrite for the reduction of non-specific colouring. Approximately the same inhibiting effects (40-50% with nitrite: about 85% with eriochrome black) were obtained with conjugates of different F/P values. The optical fibre system was also used to determine the effect of the above named substance on non-specific colouration of slices of liver. In this system the non-specific colouring was strongly reduced by eriochrome black whilst treatment with nitrite on the other hand, did not induce any inhibiting effect. The applicability of nitrite and eriochrome black to the

reduction of non-specific colouring could be demonstrated further by the absence of effects on the intensity of the specific fluorescence in salmonella bacteria. The effect of eriochrome black was also studied in clinical test specimens infected with salmonella or tularemia bacteria.

B5 Protection against biological warfare including studies of technical systems

(63) FOA report A40012-B5

Disinfection and decontamination. Principles and methods

A. Bovallius and P. Anders

November 1975

See also reference (69)

The report gives a lucid description of different means and methods for disinfections and decontaminating different objects. The results of some tested decontamination methods on active service are described and the possibilities of attaining good results from disinfecting different types of objects are discussed.

The report is submitted mainly for educational purposes.

B6 Injuries and treatment (biological)

(64) FOA report B40018-B6

Synthesis of N-acetylneuraminic acid derivatives and studies of their interaction with vibrio cholerae neuraminidase (in English)

L. Holmquist

May 1975

Doctorate thesis: FOA report Vol.9, No.3, pp.1-20, 1975

Abstracts and discussion of previously published reports referred to in FRÖ 69/70-1:37, 71/72-2:94, 72/73-1:26 and 114, together with reports B40024, B40025 and B40026.

C PROTECTION - CHEMICAL

C2 Chemical warfare. Characteristics and effects

(65) FOA report C40023-C2

A report on measurements of aerosol concentration and transport time for K62 aerosol from the police spray apparatus

P. Lindgren

October 1975

A series of tests were carried out for the police authority to investigate the functioning of a spray tear gas aerosol. The procedure used is described and discussed.

The tests determined the concentration attained in a certain trial area and the diffusion rate of the aerosol spray in the same area.

The numerical results, which refer to current trial conditions, are grouped together in paragraph 5. (A summing up of results appear on page 12.)

C4 Indication and analysis

(66) FOA report A40011-C4

Tests on a Swiss apparatus for indicating nerve gas and mustard gas

G. Heimbürger and others

October 1975

It was shown that the indication of nerve gases in air required a concentration of 0.02mg/m^3 of sarin and soman together with 0.08mg/m^3 of FX at 22°C . The sensitivity to sarin and soman was adequate but for FX it lay below the limiting value of concentration which, after 30 minutes exposure results in slight symptoms. At lower temperatures the sensitivity was worse. At -24°C no reaction at all can be elicited.

Air indication of mustard gas functioned satisfactorily at $+22^\circ\text{C}$ (1mg/m^3 was indicated).

For indication of nerve gases in water, 0.5mg/l can be established for sarin and FX and 0.2mg/l for soman, which is not sensitive enough for the negative test to guarantee drinkable water for normal consumption (3 l/day).

Water indication of mustard gas is only possible when the test is carried out directly on drops of mustard gas on the surface of the water.

Conditions which are specific to FX also apply in practice to all nerve gases since the trays do not give any information as to which nerve gas is being detected.

(67) FOA report B40002-C4

A physical method for continuous analysis of supertoxic organophosphorus compounds (in English)

H. Frostling

October 1974

Doctorate thesis: FOA reports, Vol.8, No.3, pp.1-13, 1974

A summary and discussion of results published in earlier reports: FRÖ 67/68-1:37, 70/71-4:270, 72/73-1:31, 73/74-2:102, 73/74-3:198 and 73/74-4:292.

(68) FOA report

Routines in FOCAL for incremental plotting with 4k PDP8/1(E)

C. Reuterswärd

December 1975

See also reference (72)

The routines as described later in the report have been written for the 4k FOCAL store which is available in the systems TIROS and DETEF (1,2,3). It forms a version of FOCAL (FOCAL W/68) modified by superimposing codes for using D/A transforms and relay outputs in the peripheral unit AX08 and LAB8 for connecting to external apparatus such as mini-oscilloscopes and XY recorders.

These modifications control the D/A transform in absolute coordinates (X,Y) whilst the actual sub-routines facilitate direct specification of

differential coordinates (DX, DY) and among other things, are adaptable for writing in text. The report documents detailed programs for writing a numerical text with 7-figure matrices.

C5 Protection against chemical warfare including studies of technical systems

(69) FOA report A40013-C5 (B5)

Comparison of test methods for active carbon used in filters of civilian protecting mask, type 33. (Report on a visit to USA, June 1975)

E. Ekedal

December 1975

See also reference (63)

The active carbon used in the filters of civilian protecting masks type 33, is manufactured by Calgon Corporation, USA. Last year, the Calgon Co. stated 'resistance times' for the chlorpicrine (representative test gas for nerve gas) in their certificate for the active carbon. Results were well over the approved limit whilst FOA tests found the times on or below, the limit.

To find out what was the explanation of such large differences in test results, a visit was made to the Calgon Corporation in USA. Testing methods and measurement of resistance times obtained were discussed.

It was demonstrated that the method used by the Calgon Corporation did not agree with that written in KATF 8173. By way of comparison tests were carried out with both the Calgon method and the KATF 8173 method. The test results showed that Calgon's method only gave higher values than the KATF 8173 method, but that the resistance times, on the occasion of the visit, were much lower than those stated in the certificate. No explanation for this was forthcoming. In future the test should be carried out as laid down in KATF 8173.

C6 Injuries and treatment (chemical)

(70) FOA report B40029-C6

Isolation of the nicotinic acetylcholine receptor by biospecific chromatography in insolubilized *Naja naja* neurotoxin (in English)

E. Karlsson and others

August 1975

Extract from FEBS Letters, Vol.28, pp.107-111, 1972

FOA reprint 1975/76:6

See also FOA report C1483-C6, FRÖ 72/73 reference (133), (RAE Library Translation 1732)

Neurotoxin from *Naja naja siamensis* with the high affinity to the nicotine-like acetylcholine receptor has been bound covalently to ECD-Sepharos 4B. The acetylcholine receptor in the electrical organ of *torpedo marmorata* is made soluble with detergent and binds specifically to the fixed neurotoxin. The absorbed material is then washed away with the phosphate buffer eluant receptor

with a linear carbachol gradient (0-0.5M). The receptor protein so isolated binds curare and contains very little cholinesterase (0.05% of the original activity).

(71) FOA report B40032-C6

The effect of atropine on the turnover of acetylcholine in the mouse brain (in English)

B. Lundholm and B. Sparf

Extract from Eur. J. Pharmacol., Vol.33, pp.287-292, 1975

FOA reprint 1975/76:8

It has been demonstrated that when an increase of the motor activity was used as a measure of the central effect of atropine, the threshold dose for a maximum effect on mice was 5mg/kg i.v. Atropine in this case, had no effect on the initial rate of forming 3_H -acetylcholine (ACh) in the brain, from 3_H -choline (Ch). On the other hand, when the atropine was injected after 3 minutes, when 3_H -ACh had passed its maximum concentration, it gave rise to a faster than normal reduction of the 3_H -ACh percentage. This was assumed to be an indication that the atropine increases the conversion rate of ACh. The specific radio-activity for ACh did not change after the atropine injection, which contradicts this view because the newly synthesized ACh should be released first.

(72) FOA report C40025-C6

Report from the Third International Congress on Pesticide Chemistry, Helsingfors 1974

G. Heimbürger and B. Lundholm

November 1975

See also reference (67)

The report is a summary of some interesting lectures from a medical defence point of view, which were presented at the Congress in Helsingfors in July 1974.

D AMMUNITION AND WEAPON TECHNOLOGY

D1 Technology of explosives

(73) FOA report A20010-D1

Lead azide, the ideal detonant? (in English)

S. Lamnevik

November 1975

The advantages and disadvantages of lead azides as a detonant, are presented in the form of the plenary address which the author delivered to the International Conference on Research in Primary Explosives, March 1975 at ERDE, Waltham Abbey, England. The hydrolysis of lead azide and the consequences thereof are discussed. Examples are given of functional security of lead azide detonators when stored under normal and extreme conditions for periods up to 30 years.

Lead azides bound in plastics (odextrinated lead azide with up to five per cent thermoplastics) have been proposed. Some of the technical properties have been investigated and appear to be promising but the initiating capacity is not as good as odextrinated lead azides.

- (74) FOA report C20069-D1
ICT Annual Conference on Pyrotechnics, Karlsruhe, 1975
J. Hansson

October 1975

The 1975 Annual Conference in Karlsruhe of the Institut für Chemie der Treib- und Explosivstoffe, dealt with pyrotechnics. The Conference gave a good picture of the present position of the pyrotechnics. Apart from certain fundamental ideas and investigations with a number of industrial application problems, the lectures covered types of light sources, oscillating lights, smoke generators and modern methods of analysis.

- (75) FOA report C20071-D1
Ram jet engine using solid propellants. II Theoretical aspects of using NC-based propellant
T. Liljegren

October 1975

The report discusses NC-based propellants as the driving medium for ram jet engines, based on calculations of specific impulse and from energy considerations; different compositions of propellant are considered. Two different lines are discussed, the smokeless NC-based propellant and the composite modified double base propellant (CMDB propellant) containing boron and possible also ammonium perchlorate. Present day smokeless NC-based propellants give low specific impulse. To increase it to any considerable extent, the propellant must be modified by the addition of larger quantities of some inert plasticizer, which would bring about large changes in the propellant characteristics. CMDB propellant with a high proportion of boron gives high specific impulse and it can be easier to attain complete combustion of the boron in this type of propellant than in composite propellant containing boron. For the rest, NC-based propellant will not have any advantages over composite propellant.

- (76) FOA report C20072-D1
Ram jet engines with solid propellants. III Theoretical aspects of the use of composite propellants with smokefree oxidisers
T. Liljegren

October 1975

Starting from considerations of energy and specific impulse calculations, the report discusses ammonium picrate and nitro-guanidine as oxidisers in composite propellant for air/rocket engines. These oxidisers give smokefree combustion products. With carbonyl terminated polybutadienes, CTPB, they attain

high levels of specific impulse. Other nitro-compounds are also possible as oxidisers in smokefree composite propellants.

- (77) FOA report C20081-D1
Thermal breakdown of lead azides
J. Hansson

December 1975

The influence of Viton and moisture on lead azides' breakdown at increased temperatures has been studied by gravimetric analysis. Viton reduces the rate of breakdown of lead azides, probably because it protects the lead azide from moisture in the air.

- D3 Rocket engine technology and associated ballistics
See references (75) and (76)

E CONDUCT OF WAR INFORMATION AND COMMANDS

E1 Reconnaissance and location

- (78) FOA report B20002-E1
An investigation of electromagnetic wave scattering from rough surfaces based on a comparison between vectorial and scalar Kirchhoff methods (in English)
S. Høijer
FOA reports, Vol.9, No.1, pp.1-32, 1975

February 1975

The Kirchhoff method has great significance in the calculation of electromagnetic waves scattering from rough surfaces. In the report the author makes a thorough investigation of the expression for the scattered field which can be obtained by this method, when the complete vector theory is used. The results make it possible to investigate the possibilities and limitations of the simpler scalar formalism. Complete expressions for first and second order moments are given for a field varying in space and time. Then follow the successive approximations introduced and the results are compared with Beckmann and Spizzichinos results. In conclusion, the effect of a two-dimensional very uneven surface on the propagation of monochromatic and non-monochromatic plane waves is considered.

- (79) FOA report B30009-E1
A system for digital processing of pictorial information (in English)
T. Orhaug and others
Extract from Proc. Eur. Computing Conf. Interactive Systems, On-line Conferences Ltd.,
FOA reprint 1975/76:11

October 1975

Three different projects in the field of picture processing are described in the report: simulation of the reproducing system, choice of object in

microscopic pictures and management and analysis of picture data from LANDSAT satellites. The program material and computer system used for the study of these problems is described. The system comprises an all-purpose computer as well as dedicated computers. The object of the latter system is, among other things, to be able to exploit interactive analysis technique.

- (80) FOA report B30010-E1
An acousto-optic method of measuring the noise equivalent power of optical heterodyne systems (in English)
H. Eklund and others October 1975
Extract from Optical and Quantum Electronics, Vol.7, pp.361-369, 1975
FOA reprint 1975/76:12

The noise equivalent power of optical heterodyne systems at $10.6\mu\text{m}$ has been measured by a method based on Raman-Nath diffraction of a CO_2 laser beam. One of the frequency changed diffraction beams of the first order is used as the signal beam. The local oscillator beam is obtained from the separation of a part of the laser beam which enters the acoustic-optical cell. The signal power can be varied over a large dynamic range by changing the acoustic input power. A study of the likely errors show that the total error in the NEP measurement is less than 30%.

- (81) FOA report B30011-E1
Seasonal effects on ground wave propagation in cold regions (in English)
A. Blomquist
Extract from J. Glaciol., Vol.15, pp.285-303, 1975
FOA reprint 1975/76:13

The ground wave is the most significant part of a radio wave in connection with glaciology. In cold climates it is often necessary to pay special attention to the conditions such as, the propagation of waves over non-homogeneous ground, in ground strata, and in the presence of low values of conductivity and dielectric constants.

A radio wave propagated far over the earth's surface is also influenced by atmospheric conditions. At increasing frequencies the unevenness of the ground is an additional influence. Seasonal variations to be reckoned with in this way depend on changes in the ground's electrical and topographical properties, as well as the propagating conditions in the atmosphere. However, it is very difficult to separate these different effects, which reduce the possibilities of using ground propagation as a means of deriving knowledge of the earth's surface characteristics.

Although the ground waves' propagation has been the subject of detailed theoretical and experimental studies for some hundred years, the most valuable

information, especially on geographically cold regions, has been obtained during the last decade. New theoretical work on propagation over stratified media has provided an explanation of the observed variations in the amplitude and phase of ground waves. These investigations have also suggested new methods based on the ground wave, which should prove useful, in the solution of glacial problems.

Assuming ground wave propagation in the arctic regions, the ground wave field strength can, in practice, often be written in very simple mathematical terms. A propagation model of this kind for frequencies above 30MHz is described in which the curvature of the earth's surface is taken into account together with the influences of the terrain and the troposphere.

The model includes an inbuilt recovery effect which occurs in propagation over distances containing different electrical properties. At very high frequencies the depolarizing effect becomes significant and can sometimes mask variations in field strength which are determined by the ground electrical characteristics.

In conclusion, some problems are discussed which have as yet remained unsolved or received very little attention.

(82) FOA report C30026-E1

A study of methods and techniques for digital processing and analysis of pictures

Visit Report USA, November 1974

T. Orhaug

May 1975

The report summarizes information obtained at two conferences on 'Near future prospects for image pattern recognition' and 'Digital image processing workshop' as well as visits to industry. Special attention is given to the following subjects:- remote analysis from satellites, armament control by exploitation of reconnaissance with imaging sensors, interactive picture processing systems, automatic picture analysis, and the development of data storage and picture generation.

(83) FOA report C30030-E1

Description of band pass filters for filtering frequencies of signals from seismic and microbarometric measurements

G. GÖransson

June 1975

The report describes the construction of band pass filters for filtering frequencies of signals from seismic and microbarometric measurements. The pass band filters are designed for frequencies 1.5-4Hz and 3.5-7Hz and for period times of 25-100s (0.04-0.01Hz) 55-220s (0.01818-0.004545Hz) and 100-400s

(0.01-0.0025Hz). The attenuation curves for the filters with pass band 3-5.7Hz and 1.5-4Hz have 'roll off' of 24dB/octave. The remaining filters have filter edges with 'roll off' of 18dB/octave. Each band pass filter is constructed from series coupled high and low pass filters. The report first explains the theory for high and low pass filters used in the band pass filter, followed by a description of the construction of the band pass filter.

(84) FOA report C30040-E1

The detection of oil leaks by means of airborne and shipborne radar
J. Nilsson and T. Hagman

October 1975

The possibilities of detecting oil leaks on the sea has been investigated for air and shipborne radars. In the case of airborne radar, oil films due to leakage of EO3 give enough contrast for detection at distances of about 15km and wind speeds exceeding 4m/s. This assumes that the oil streak exceeds the area corresponding to the minimum surface that the radar can detect. The necessary thickness of oil layer for a wind speed of 4-5m/s is less than 0.5 μ .

Thin oils (e.g. petroleum for aircraft) are in layers which are probably broken up by large waves before the surface area becomes larger than the detection area required by the radar in use.

In high winds of 13-15m/s the oil streaks are blown out into long bands separated by water surfaces with no oil and with normal sea echo intensity, so that the direction of flight should be chosen across the wind for a forward surveillance type radar, if the radar's high radial resolution is being used.

For wind speeds between 5 and 10m/s the oil streaks continue unbroken and can be detected at least 18 hours after leakage of 400 l EO3 oil.

Shipborne radar has a range mainly determined by the height of the antenna over the surface of the sea. The antenna height used in the trials was 9m and the range was approximately 0.75nm.

(85) FOA report C30051-E1

Laser probing of the upper layers of the atmosphere
Translation from Russian by H. Engström

October 1975

The propagation of light from a pulsed light source into an atmosphere which is heterogeneous at heights along the laser beam has been calculated using the Monte-Carlo methods. The results obtained refer to an atmosphere free of clouds, with varying degrees of cloud and with varying geometry in the technical installation. It has been shown that the multiple propagation element is in most cases, the smaller of the two. The available material is used for an

estimation of the signal/noise relationship in the observation of distant objects.

E2 Communications

(86) FOA report A30004-E2

Noise levels for acoustic alarms in built-up areas

B. Granath

September 1975

At the request of the Civil Defence Administration problems have been studied in connection with acoustic signals for giving the alarm in built-up areas. After a general survey of different alarm signal mechanisms, a review of reported measurements is given. The perception of alarm signals is discussed followed by an estimate of the proportion of population in a built-up area who are alerted by sound signals of different intensity. Measurements of sound pressure levels are examined from a number of receiving and transmitting sites. From the measured results an estimate is made of the resulting sound propagation attenuation in a built-up area. In conclusion, a theoretical calculation is made of the median levels to be expected over a city area.

(87) FOA report A30005-E2

Observations and recommendations on the choice of frequency and station sites for a civil alarm system

L. Ladell and Å. Blomquist

October 1975

The report is a final account of a study of the frequencies suitable for a civil defence alarm system. The report consists of chapters on the natural assumptions and limitations so as to outline a suitable frequency range for the system, and also of calculations of transmission losses starting from a basis of detailed maps for a number of distances inside the Gothenburg civil defence area, as well as verification of these calculations by field strength measurements.

An experiment has been carried out on the basis of these calculations to assess the situation in different types of territory in the country. The results show that for flat country, the choice of frequency can be anywhere between 50-500MHz. However, should a common frequency be desirable for the whole country the wave propagation relationships must first be determined for a hilly terrain. A frequency around 70MHz is recommended. The lower limit is determined by the remote noise level and the need for the receiving antennae to be of reasonable size.

Horizontal polarization can be exploited for the whole system. The depolarization which the radio wave is exposed to along the line of propagation

is, of course, so large that for mobile application the vertical polarization can be used on the mobile receiving station. In doing so, a reduced inbuilt performance level must be accepted.

(88) FOA report C30031-E2

Dielectric and absorbing material and integrated microwave circuits.

Visit to the USA, June 1974

Å. Bergquist

May 1975

The report is an account of impressions and information obtained during visits to a number of private enterprises and national institutions in USA. The main purpose was a study of integrated microwave circuits, dielectric and microwave absorbing materials and interesting methods of measurement. As side interests, there were other subjects such as antennae techniques and microwave acoustics, etc.

(89) FOA report C30046-E2

Investigation into the performance of Siemens FEC-100 on HF links

R. Ullander

December 1975

See also reference (81)

A comparative investigation between an unprotected element-synchronous data transfer system (teletype) and a direct error correcting system, Siemens FEC-100 has been carried out on an HF link.

The report contains a description of the coding method used in the FEC-100 together with its qualities.

E4 Guidance, navigation and target characteristics

See reference (91)

E5 Computer technology

(90) FOA report A30003-E5

System coordination relating to machinery for registration, treatment and presentation of pictorial information. An account of the AG Repris analytical work

Collated by J. Lexander

August 1975

Defence command will shortly be obtaining equipment for recording, treating and presenting picture information and for this occasion it has been considered both important and advisable to define the requirements for coordination of the system. Such equipment is necessary for the development activities of the Defence industries in the field of optics and radar, as well as for FOA interest in research, for example, in the biotechnological field. With such system coordination it is intended to guarantee as far as possible, that stored picture information may be used for measurements and studies of all such equipment.

On the initiative of FMV-F:VT, a working party was set up in Ag. Repris during November 1974, for the purpose of investigating questions arising on system coordination and to recommend a course of procedure.

The investigation has shown that very wide limits in the experimental equipment performance can be permitted in stating specification requirements for the recorded raw information. The suggestion put forward by Ag. Repris is that coordination of the system is achieved by a flexibly constructed adaptor unit which converts all types of picture making patterns into the desired signal format, e.g. a standard TV format.

(91) FOA report C20084-E5

SPODE simulation package for systems modelled by ordinary first order differential equations - User's manual (in English)

G. Fick

December 1975

See also references (109) and (110)

This is a user's manual for *SPODE*, a program used as a simulation package for systems modelled by ordinary first order differential equations. These must be written in *FORTRAN* or stated with matrices. The program is largely modular and is readily adaptable to complicated problems. *SPODE* can be connected as a simulation unit in a program with wider objectives. The program gives useful and non-cryptic result presentation with *CALCOMP* style figures. Derivatives containing discontinuities can be dealt with. The present version is intended for working in stages. The program has mechanisms for pre- and post-treated, problem-specific, program sections; it allows closely applied model structures, many sided iteration possibilities and satisfactorily deals with many such demands from system techniques.

E6 Countermeasures

(92) FOA report C30035-E6

Large signal detection in the S, X and K_u bands

B. Peterson

September 1975

The development of some different types of large signal detectors intended for the S, X and K_u bands are described. 'Beam lead' Schottky barrier diodes are used in micro strip circuits. A general measuring method for the characterization of a detector diode's large signal properties is suggested.

(93) FOA report C30048-E6

Simple warning device for laser beams

H. Eriksson and L. Gustarsson

October 1975

The report considers possibilities of detecting laser beams belonging to different weapon systems, by means of a laser warning device. From the point

of view of power output, lasers can be divided into two groups; those with high output can be detected by a simple warning device. Such a device has been constructed at FOA for the purpose of estimating the complexity, dimensions and performance.

E7 System studies

(94) FOA report C30052-E7

Program for calculating equivalent ground echo area
A. Neland

October 1975

The program calculates the ground echo signal which reaches radar receivers, mainly via the antennae side lobes, for a given elevation of the main lobe and distance from target. Calculations are made for each distance, of the equivalent ground echo area, from the integral of the specific ground echo area taking into account the square of the antenna gain function. Two types of gain functions have been used. The results are set out in a table as functions of the distance and of the antenna's elevation angle.

E8 Reviews and threat scenarios

(95) FOA report C30041-E8

VLF phase anomalies due to particle precipitation at mid-latitudes (in English)
G. Holmgren and O. Laback

October 1975

Recordings of phase and amplitude from a world wide network of VLF communications have been investigated. The object of the exercise was to derive the characteristic properties of particle precipitation at mid latitudes from experimental results.

Maximum phase deviations and durations for some 700 disturbances in the communication between NLK (Washington State) and Deal (New Jersey) have been studied statistically.

A few of these disturbances have been studied in greater detail. NLK-DEAL recordings have been compared with those from a number of other VLF links and the variation of the electron stream in the plane of the equator at 6.6 earth radius distance, based on measurements by the geo-stationary satellite ATS-1.

It was found that during geo-magnetically active periods there was a positive correlation between the VLF anomalies and the increase in the particle stream in the plane of the equator; the disturbances extended farther to the South when the geo-magnetic activity was high; the maximum phase deviation for VLF links on medium high latitudes showed no pronounced dependence on the degree

of geo-magnetic disturbance in the northern lights latitudes; it seemed that the disturbances bent eastwards during active periods in some of the disturbances; propagation of VLF at medium high latitudes seemed to be influenced by particle precipitation even during what appeared to be calm conditions.

F VEHICLES AND SPACECRAFT

F3 Aircraft

(96) FOA report C20074-F3

Determination of gases in metals by a levitation-carrier gas technique
(in English)

K.F. Alm and others

November 1975

The report describes a method for the determination of hydrogen, nitrogen and oxygen in metals by means of a levitation-carrier technique. The sample reacted with carbon dissolved in a bath of molten metal (iron) which was held in suspension in a conical coil fed with high frequency alternating current. The reaction takes place in a glass or quartz container and the gases given off are conveyed by a stream of gas to the analytical system (gas chromatograph). Evaluation of the method shows that the following values can be demonstrated:- 0.01µg for hydrogen, 0.5µg for nitrogen and 0.5µg for oxygen. The relative standard deviation is 2-4% in the range 100-1300 ppm and sample sizes of 20-70mg.

The levitation-carrier gas method has been used for the determination of oxygen in wolfram alloys as well as zinc alloys, and of hydrogen in electrolytic copper.

(97) FOA report C20078-F3

Rationalized spectrochemical and X-ray fluorescence spectrometric analysis.
II. Quantitative spectrochemical analysis

B. Gelin and E. Holm

December 1975

A technique previously described for conducting experiments with X-ray fluorescence spectrometric and spectrochemical analysis has been modified and the spectrochemical technique has been developed so that quantitative determinations can also be made of trace elements in different materials such as rocks, oxides, metal alloys, and plastics etc. After the sample has been melted with borax, the borax glass produced is crushed and ground and mixed with graphite powder. Excitation is obtained from a direct current arc between graphite electrodes in a protecting atmosphere (of argon oxygen) for approximately five minutes.

- (98) FOA report C20079-F3
Visit report on "Reinforced plastics" Congress at Brighton in November 1974
and study visits arising from it
R. Söderqvist
December 1975

The report gives impressions from a study visit to England in 1974 comprising attendance at the Reinforced Plastics Congress in Brighton and a visit to the Royal Aircraft Establishment, Farnborough on 11th November and to AERE, Harwell on 15th November.

G RELIABILITY AND LOGISTIC TECHNOLOGY

G2 Reliability and inspection techniques

- (99) FTL A report A16:60
A computer based general reliability data bank
I. Hansson and others
September 1975

This report describes a computer based general reliability data bank developed at FOA/FTL during 1973-5. The project was financed by the Director of Technical Development (STU).

The bank is basically a raw data bank which can store progress reports, test results, etc. for a variety of objects. The data is in the form of events and their time of occurrence (or equivalents) for these.

The bank is suitable for industries as a valuable complement to the progress systems which have or will be established. The bank's first purpose has become apparently the storage of progress reports from a planned examination of functional security of private motor cars.

The bank has been constructed on the lines originally drawn up by Henrik Broberg of FTL. The project leader during development was Ingvar Hansson FTL, who was also responsible for the problem orientated system work. The computer orientated system work and the programming was carried out by the calculation section of G. Erlefjord and L. Jönsson of FOA3.

The computer program which is largely conversational is written in FORTRAN IV.. The equipment used was the Stockholm's Computer Centre DEC10. The conversation with the computer was achieved via an alphanumerical terminal.

H HUMAN FACTORSH2 Environment technique and field hygiene

(100) FOA report B54001-H2

Distribution and fate of the insect repellent ^{14}C -N, N-diethyl-m-toluamide in the animal body. I. Distribution and excretion after injection into mice (in English)

L. Blomquist and others

November 1975

Extract from Acta. Pharmacol. Toxicol., Vol.37, pp.121-133, 1975

FOA reprint 1975/76:4

Tissue distribution of ^{14}C tagged N, N-diethyl-m-toluamide (DEET), a normal midge repellent, has been studied in mice, mainly with the help of whole body auto-radiography. After intravenous injection of the substance high radio-activity concentrations were found mainly in the liver, kidneys, tear glands and the nasal mucous membrane. A short time after the injection high activity concentrations were found in the thyroid gland and brown fat tissue. Quantitative measurements showed that the highest radio-activity was recorded in the tear glands where the activity also remained longer than in other tissues. Prompt excretion of radioactive material occurred mainly through the kidneys. Four hours after injection there remained only very small radio-activity in all tissues with the exception of the tear gland. A placental barrier which resulted in much lower radio-activities in the foetus than in the mother, was observed.

(101) FOA report B59001-H2

Determination of pilot performance during heat stress in a flight simulator (in English)

L. Larsson and others

December 1975

Extract from Försvarsmedicin, Vol.11, pp.156-162, 1975

FOA reprint 1975/76:15

A preliminary study has been made for the purpose of finding a method for measuring the effects of heat stress on the performance of a pilot during flight and to evaluate the contingent flight safety risks.

Four military pilots were tested under neutrally thermal control conditions (21°C) and also under heat stress in a Draken aircraft (No.35) analogue flight simulator. Realistic heat stress temperatures were maintained for 2 hours beforehand in a climatic cabinet (30°C) and then followed a 36 minute flight programme on the flight simulator (50°C). The flight programme consisted of flying on different courses requiring constant bearings, speed and height throughout the programme. A series of eight repeated tests were carried out with alternating thermoneutral environment and heat stress. Physiological reaction to the environment was evaluated by continuous recording of head and deep body temperatures. A second series of eight repeated tests were also

carried out with alternating hypoxia (corresponding 4000m) and normal control conditions (21°C) in the simulator.

The sum of the integrated deviations from the required height and speed were chosen as relevant measurements of the pilot's performance ability. The relation between the sum of errors from the first 9 minutes of the control flying period and the mean of the last 9 minutes of that immediately before and after the heat stressed flying period, was taken as an expression of the change in performance ability. A statistical evaluation of the quota for all trial personnel showed that, compared with the controlled conditions, there existed a significant reduction ($P = 0.01$) of performance ability during the combined heat stress period, which was quite as big as the significant reductions ($P = 0.03$) because of hypoxia.

(102) FOA report B59002-H2

Survival and rescue of astronauts in the polar regions

O. Wilson

December 1975

Extract from Forsvarsmedicin, Vol.11, pp.163-168, 1975

FOA reprint 1975/76:16

The report presents some points of view on the survival and rescue of astronauts in the polar regions. A forced landing in the arctic environment can involve open water, pack ice, inland ice, snow covered tundra or rocky mountainous terrain. Open water and mountainous conditions are not discussed here. Pack ice implies the most dangerous situation, with a high risk of loss for the space capsule; otherwise the conditions are comparable to landing on inland ice or tundra. The chances of survival are significantly increased with an undamaged vehicle, which offers protection and additional resources. Should the vehicle be lost then the situation is much worse because space clothes provide insufficient protection for polar conditions and also because survival rations are not intended for use in the arctic. Increased protection for the extremities and head, a source of heat for melting snow and material to provide a survival tent are the principal needs. An essential for survival of an astronaut is a training in an optimal use of existing equipment in arctic conditions, instructions for improvising other necessary equipment and access to a minimum of vital accessories. The latter include an anarak cover, gloves, overboots, heat for melting snow and a handbook on survival. Some of the present survival packs can be adapted for use in polar regions. The chances of being rescued depend on the capability of transmitting distress signals in the cold, the possibility of being spotted from the air and the effectiveness of the rescue organization in

reaching the landing site despite inaccessibility, severe weather conditions and polar darkness.

(103) FOA report B59003-H2

Heart frequency and muscle reactions in women exposed to sonic booms
(Bang 72)

B. Andrae and H. Nilsson

December 1975

Extract from Försvarsmedicin, Vol.11, pp.177-182, 1975

FOA reprint 1975/76:17

As a preliminary to research on the effects of sonic booms on humans, a series of field trials were conducted in cooperation with the Environment Hygienic Department of the State Nature Trust, in South Gotland (Bang 72), firstly to find out the origin of surprise and fright reactions. Exposure to noise from aircraft (type 35 Draken) flying above and below the speed of sound, and also a pistol shot, gave rise to a transitory mild increase in heart frequency and certain muscle reactions in female trial personnel. The noise level of the bangs varied between 60 and 640Pa outdoors. The corresponding indoor values were between 20 and 130Pa. The trial indicated that sonic booms only cause mild circulatory changes with no harmful effects, at any rate in a normal population.

H6 The capacity and conduct, including group factors in leadership, mainly under war conditions

(104) FOA report B57004-H6

Psychobiological circadian rhythms during 72 hour vigil (in English)

J. Fröberg and others

December 1975

Extract from Försvarsmedicin, Vol.11, pp.192-201, 1975

FOA reprint 1975/76:14

Circadian rhythms in catecholamine discharge, oral temperature, efficiency and subjective alertness have been studied in 32 trial personnel subjected to a 72 hour vigil. Adrenaline discharge, oral temperature and level of self-imposed wakefulness showed clear circadian variations (about 24 hours). The rhythm of efficiency was more irregular and noradrenaline discharge revealed no significant rhythm. The maximum for adrenaline rhythms was between 1200 and 1500, for subjective wakefulness and efficiency about 1600-1700.

H7 Examination and choice of personnel

(105) FOA report D55002-H7

Comparable assessments? The connection between the infantry platoon command school 73/74, which produced an assessment after completing basic training and estimates from the psychological enrolment variables

G. Wellins

November 1975

The present investigation is a comparison between all entrants to the infantry regiments in 1973/74 with respect to their psychological enrolment variables and assessments at the end of basic training.

Assuming that there is no difference between the different regiments, the whole of the material should be available for a valid investigation of the psychological enrolment variables. At the moment there is an almost constant difference in assessments between the regiments. Between training units, only in some individual cases does a significant difference in assessments occur. The differences in assessments in the psychological variables which appear to be valid from comparisons between training units are not valid in comparisons between regiments. Possible explanations of the differences in assessments between regiments are discussed. One way variance analysis has been used, where the independent variables are made up from training unit and regiment respectively and the dependant variables made up from the psychological enrolment variables and assessments.

H9 Man and machine systems

(106) FOA report A57003-H9

Small protection shelters: experimental covering VT 75
G. Stensson and others

October 1975

Fittings and equipment in small protection shelters have been studied in a 48 hour shelter trial. The environmental development and environmental effects were also studied simultaneously in the shelter.

The experiment with the small shelter - (6m²) - showed the need for well shaped seating accommodation and good cloakroom facilities if five people were to reside there for a longer time.

The climate, air temperature, humidity and smell experienced were not specially troublesome. The humidity on walls, floor and clothes only became apparent towards the end of the test period.

M ASSOCIATED STUDIES AND THEIR SOLUTION

M2 Environment and framework studies

(107) FOA report B10011-M2

Problems in Swedish security (in French)
N. Andrén

October 1975

Extract from Politique Etrangère, Vol.40, pp.43-57, 1975
FOA reprint 1975/76:9

The author deals with two basic problems in the external security of Sweden, namely the credibility of the country's neutrality politics, and the underlying prerequisites for maintenance and development of its defence. The paper was first presented as a lecture to the International Institute for Strategic Studies in London on 7 October 1974.

(108) FOA report B10013-M2

The biological weapon convention and its political security significance.
Prospect of Swedish ratification

J. Lundin

December 1975

Extract from K. Kr. V.A. Tidskr., Vol.179, pp.199-208, 1975

FOA reprint 1975/76:18

Prospects of the approaching consideration in the Riksdag of the Swedish ratification of the B Weapon Convention which forbids the development, production and storage of biological means of warfare, is described for use on the history of the Convention. The consequences on political security of the Convention coming into effect by law (1975) are analysed. It is pointed out that a contribution of biological means of warfare can occur under special conditions without reference to either the Geneva Protocol (1925) forbidding its use, or the B Convention's prohibition of procurement.

M3 Predictive planning

(109) FOA report C10040-M3

Machine efficiency versus programming efficiency (in English)

J. Palme

October 1975

How should one weigh programming efficiency against the effective exploitation of a computer? Is a comparison possible? How can the cost of programming be reduced? Can advanced aids to programming be used? Can a program language increase reliability and reduce the increase in costs by errors? What kind of language gives the most effective objective code? How should one weigh cpu-time against effective memory exploitation? Why do certain high level languages have problems of effectiveness with their generated object code?

(110) FOA report C10042-M3

Communication between man and machine

J. Palme

November 1975

What human needs are influenced by the computer? How do computers influence the people that use them? What sort of communications does the computer give rise to with people? How can one construct computer systems so that they meet the needs of people better?

This report discusses these problems and describes different methods. Among others, it discusses computer control, command control and natural language communication between man and machine.

A version of this report is available in English under the title "Interactive software for humans", FOA report C10029. The report also contains a more detailed bibliography.

M4 System and program planning

(111) FOA report A20009-M4

Documentation of computer programs at FOA
M. Franzén and others

October 1975

A part of computer programming that is often neglected is documentation, i.e. the part that describes a program's construction, function and mode of use.

The FOA program service which, among other things, has information for preparing uniform documentation principles, has accordingly, taken the initiative in revising the documentation instructions for research published in 1969. The present report takes into consideration the experience gained in applying these instructions and also the recommendations from FRI about rules for documentation in defence. The FOA rules should be linked to the definitions of conceptions as indicated by FRI as a matter of urgency.

These instructions are intended to be applied to programs for both large and small computers.

(112) FOA report C20083-M4

Deviations from Standard *FORTRAN* - when, where and how for FOA?
M. Franzén and others

December 1975

Since the cost of development of computer programs tends to increase whilst the price factor for hardware falls, it is important that programs should be written so that they can be moved between different computer systems to the greatest possible extent. In many cases one tries to achieve flexibility by using Standard *FORTRAN*. There are still a number of deviations from Standard *FORTRAN* which are used to a large extent by IBM 360 and DEC-10 programmers at FOA and which greatly facilitate programming work. Several of these extensions are considered indispensable.

The report gives recommendations concerning the use of deviations from Standard *FORTRAN* and the documentation of these in the program.

The report has been prepared at the request of FOA programmers.

M5 Forecasts

(113) FOA report B10002-M5

The art of conjecture - an analysis
H. Stenlund

Extract from "Än se'n då...discussions on future studies", pp.14-21,
Stockholm 1974

FOA reprint 1974/75:10

- (114) FOA report B10003-M5
Technical forecasts for decision makers - an introduction and comments
B. Schwarz
Extract from "Än se'n då....discussions on future studies", pp.40-47,
Stockholm 1974
FOA reprint 1974/75:11
- (115) FOA report B10004-M5
Apocalypse and charisma - thoughts on the book "Limits of Growth" and the
Rome Club phenomenon
S. Schwarz
Extract from "Än se'n då....discussions on studies of the future, pp.48-75,
Stockholm 1974
FOA reprint 1974/75:12
- (116) FOA report B10005-M5
What is to come will....or?
M. Wängborg
Extract from "Än se'n då....discussions on future studies, pp.76-92,
Stockholm 1974
FOA reprint 1974/75:13
- (117) FOA report B10006-M5
Planning and studies of the future. Responsibility of enterprise for the
common good or democratic control in the interest of the majority?
A. Sandberg
Extract from "Än se'n då.... discussions on future studies, pp.93-111,
Stockholm 1974
FOA reprint 1974/75:14
- (118) FOA report B10007-M5
Studies on the future - how far have we come?
T. Gerholm
Lecture at Norrøna - Conference, Stavanger, 19-20 April 1974
FOA reprint 1974/75:15
- (119) Knowledge and conceptual problems in studies of the future
S. Schwarz (Editor) September 1975
Försvarets Forskningsanstalt, Stockholm 1975, xv+233 p.7, Fig.5, 5 tables

What is necessary in order that decision making shall be regarded as a conscious responsibility? Among other things one can reasonably suppose that the decision maker has made a substantial effort to examine a series of possible alternative courses of action (direct and indirect, desired and undesired). The objectives set up and the accepted ways of attaining them, will have to be in reasonable agreement with values and standards for the subjects affected and on whose behalf the decision maker acts, a trust which is a prerequisite for his authority. It may be in this that the conflicts of interests and values must be solved.

This book deals with, or touches on, a number of questions upon which a decision maker will need to take a stand either consciously or unconsciously.

- How can one make a pronouncement about the future on the basis of knowledge and experience if it is long past? What is the meaning of, for example, 'pattern' or 'trend'?
- What limitations to the chances of describing and understanding a situation or development, lie in the self choice of the method of approach or 'model'?
- What justification is there for expecting that a method (or model) which gives plausible agreement with experience, will give a description of future conditions?
- How can the planning process be shaped so that the basis of decision will be regarded as fulfilling its real meaning? For example, how will the value of a prognosis or the meaning of uncertainty be decided?
- How will one become aware of, and take into account, values and standards in making rational decisions?
- What control mechanisms are necessary in the decision making process so that the originator of a request for advice can have confidence and guarantees that the delegated authority and resources have been administered for responsible, conscious decision making?
- What is the influence of political ideologies and other influences and attitudes on the chances of obtaining rational processes for making decisions?

S. Schwarz: Foreword - Studies about the future, conscientiousness and responsibility. M. Edman: No naïve prognosis methodics exist. H. Stenlund: A study of the prognosis concept. G. Näsman: A proposal for constructing a concept for trends and future trends. U. Strömquist: The consequences of economic growth in mutual dependence. B. Schwarz: Some conceptual problems in long term planning. H. Wiberg: How can one assess statements about the future? G. Hermerén: Rational argument: on appraisal and standards in studies of the future. S. Schwarz: Advice and criticism in decision processes. S. Halldén: The study of the future as seen by the left.

N MILITARY ENGINEERING RESEARCH

(120) Fort F/F report No.103:44

On measured pressures and running (propagation) times of shock waves in TNT charged shock tubes (in English)
H. Weibull

December 1975

The purpose of the investigation was to study shock waves generated by TNT charges of different weights, in tubes of different diameters and to compare

them with shock waves not in a tube. Propagation times, propagation path and frontal pressure were collected from articles in technical journals. The diameters of the tubes noted in this way varied from 0.05m to 6.0m. The charges weighed from 1.5g TNT to 500kg TNT.

The overall laws are discussed and values of propagation time and path are collected together and reduced to a tube with 1.0m diameter and a charge weighing 1kg TNT.

The values collected are compared with known physically derived equations and polynomials, and the deviations from these equations give a measure of the accuracy of the measurements.

T POSITIVE MEASURES FOR LIMITATION AND CONTROL OF ARMAMENTS

T1 The seismological multiple station

(121) FOA report B20006-T1

Some statistical models for seismic discrimination (in English)

E. Elvers

October 1975

Extract from G.P. Patil *et al.* (eds.), Statistical distributions in

Scientific work, Vol.2, pp.321-326. Reidel Dordrecht 1975

FOA reprint 1975/76:7

Seismic discrimination between earthquakes and explosions are usually based on a comparison of two seismic magnitudes. More or less detailed models are used for the statistical distribution of these and lead on to some different discrimination procedures.

(122) FOA report C20070-T1

Seismic event identification by the $m_b(M_s)$ method (in English)

E. Elvers

October 1975

The $m_b(M_s)$ method which uses the magnitudes for deep and surface waves from a seismic station to distinguish earthquakes from underground nuclear explosions, has been studied in the form which includes indirect identification when only one of the magnitudes is obtained. The thresholds of detection for the magnitudes varies with time and the significance of this for the size dependent classification probabilities are considered first. These average values are calculated as an overall measure of the method's capacity when applied for a long time and an alternative classification procedure based on these mean probabilities is discussed. In the second part of the study the significance of seismology is dealt with in the same way. The earthquake process is described by a model which is in agreement with that generally accepted for the deep wave magnitude distribution and a method for estimating the input

parameters is given. If the classification principle is altered to specify the selected overall measure, that is on average the number of false alarms per time unit, then one no longer obtains a clear increase of the probability of classifying an explosion correctly by including indirect identification but for higher power events the reduction can be small compared with the improved applicability. This is the case in the numerical example studied which is based on actual data.

(123) FOA report C20073-T1

Evasion by hiding nuclear explosions in earthquakes from the Aleutian Islands, the Kuril Islands and Kamchatka (in English)

I. Jeppsson

October 1975

The results of an earlier report which dealt with the method of concealing nuclear explosions in earthquakes (Jeppsson 1975, RAE Library Translation 1866, reference 547) has now been applied to three more regions: the Aleutians in USA and the Kuril Islands and Kamchatka in the Soviet Union. Despite high seismic activity in these regions the number of opportunities of concealing an explosion is fairly small. For a nuclear charge with an expected deep wave magnitude of 4.5 situated somewhere in the area, the number of explosion occasions are only two or three per annum, if it is assumed that the concealing earthquake must happen within a distance of 500km from the site of the explosion.

(124) FOA report C20077-T1

Earthquakes and earthquake risks in Sweden - a preliminary study

O. Dahlman and others

November 1975

The present report was prepared at the request of The State Waterfall Authority and presents a preliminary study of observed earthquakes in Sweden and the ground movements that are to be expected from them.

The report gives the localities of earthquakes during the last seventy years, as reported in Sweden, Finland and Norway either by direct observation of the quake effects or by instrumental seismic recordings. The magnitude distribution of the earthquakes observed is discussed. From the reliable connection between the number of earthquakes and their size, the probability of earthquakes has been estimated in different parts of the country.

Certain foreign ground acceleration measurements are discussed as well as some attempts to estimate the maximal ground acceleration for the larger earthquake in Norden 1904. Also discussed is the amplified effect that the local ground material can have on earth movements. The report points out that the lack of first hand seismic measurements in the neighbourhood of Swedish

earthquakes and the uncertainty as regards the depth of the earthquake largely limits the possibilities of predicting the ground shocks which can arise in Swedish earthquakes. Further studies to explore these latter problems are recommended.

(125) FOA report C20080-T1

A discrimination problem from seismology (in English)

E. Elvers

December 1975

The seismic discrimination between earthquakes and underground nuclear explosions have been studied, based on the magnitudes of the two classes observed from several seismic stations. First a model is given where the mean values of the magnitudes are linear functions of a parameter which describes the power of the incident. It shows how the model parameters can be estimated closely. When the discrimination rules are derived from the model they are approached from different sources which appear to be coincident. It is found to be convenient to use a discriminant which is linear in the magnitudes and explicit formulae are derived. The method's power is expressed by a separation measurement between the alternatives which also shows the weight of individual magnitudes. Lack of data is a normal practical problem and the case is dealt with where a detection threshold exists for one of the magnitudes. The classification probabilities are calculated when the rules for the magnitudes obtained are applied. The probabilities depend on the power of the incident. The method is not optimal, and it is shown that it can be improved by exploiting the technique for indirect identification, i.e. by the use of the threshold value as the upper limit for an absent magnitude. The model is in general use and the results have therefore a wide application.

T2 Collection and analysis of airborne radio-activity

(126) FOA report B40016-T2

Some aspects of the prevention of clandestine development of nuclear weapons in connection with peaceful nuclear explosions (in English)

L-E. De Greer and G. Persson

October 1975

FOA reports, Vol.9, No.5, pp.1-4, 1975

If an agreement is signed which forbids nuclear weapon tests altogether but allows nuclear explosions for peaceful purposes, then it is important to have methods to distinguish a weapon test from a peaceful explosion. Such methods are discussed on the premise that selected characteristic capacities for the peaceful nuclear charges will be specified carefully and afterwards some international organization will verify this data following an explosion. To avoid the risk of excessive spread of nuclear weapons the control methods should be designed so that important construction principles are not disclosed.

T3 Technical scientific investigations etc.

(127) FOA report B10009-T3

Description of a model for defining chemical warfare agents in an international treaty (in English)

J. Lundin

June 1975

FOA reports, Vol.9, No.4, pp.1-10, 1975

Different attempts to define chemical warfare materials in relation to other chemicals are analysed. This is in connection with the disarmament negotiations in Geneva. A comprehensive model which takes into account the problem in all its aspects is described. The model has dynamic properties which permit alterations to meet future agreements on chemical disarmament.

(128) FOA report C20082-T3

Peaceful applications of nuclear explosions

L. Wallin

December 1975

The report is intended to give a survey over the field of peaceful applications of nuclear explosives. The introduction gives some examples of useful possibilities together with a description of a nuclear explosion below ground. A summary of what has been done and is being done in this field nationally and internationally, is followed by a short discussion on the advantages and problems with peaceful nuclear applications. The risks of nuclear weapons spreading because of these applications is touched on and the report concludes with an attempt to forecast future development in the field.

EMERGENCY COUNCIL FOR PSYCHOLOGICAL DEFENCE

(129) BN memorandum No.67

Definitions and measurement of the will for defence

K. Törnquist and K. Aggefors

August 1975

The memorandum contains a brief report on the suggestions and discussions that took place at the Emergency Council's Research Symposium in Västerås on 23-25 April 1975. It dealt with definitions and methods for measuring the will for defence.

(130) BN memorandum No.68

The USA's military obligations

K. Törnquist and K. Aggefors

November 1975

This memorandum reviews the result of an opinion poll of the American people's views regarding the USA's military obligations to supply troops or equipment to foreign countries. The memorandum is a translation of a special article in the Gallup Opinion Index of July 1975.

(131) BN report No.70

The will for defence and closely related concepts
K. Törnquist

October 1975

The report consists of three chapters. The first gives a summary of studies and discussions on problems with definitions and measurements as regards the will for defence and related concepts, which have been under study since the beginning of 1950. The second deals with different variations of pre-existing definitions. These provide the will to defence concept which functions as an overall concept for a number of closely allied concepts. When it comes to attempts to measuring the will to defence it is important to try to define the different concepts so that it is clear what is to be measured. In conclusion there is a discussion in the third chapter on different aspects of the measurement methods for measuring the will for defence.

(132) BN report No.71

The Swedes and defence
K. Törnquist

December 1975

The report is a review for the Emergency Council's opinion poll in September and October 1975, on the general attitude to a number of defence questions. A feeling that there is a risk of a major conflict in Europe has shown a considerable increase. At the same time it is thought that the possibilities of Sweden remaining neutral in such a conflict are just as poor as before. A similar large majority of women and men think that the women should be engaged more in defence. The conventional military defence is considered by a majority as the most deterrent form of defence. Only small minorities indicated guerilla defence and civil resistance as the most deterrent. The organisation on the basis of conscript training is still very widespread. The principle of the people's defence is accepted by an unchanged large majority. The common will for defence in peacetime continues to be widespread and extensive and shows a significant stability.

Regarding military defence, a majority consider that we ought to stay much as we are now. The civilian sections of total defence, in relatively large minorities, thought we should make a larger commitment.

As in the previous year, the majority wanted the cost of defence to remain unaltered.

(133) BN unnumbered report

Consideration of construction for an index and the like
A. Wikman and others

November 1975

In their consideration of an index the authors proceeded from two sorts of precision deficiencies in the opinion poll investigations, namely those

conditioned by the size of the sample and methods of measurement and those caused by a lack of stringency in the thinking of the people interviewed. In order to reduce the effect of these occasional errors one can sum up several indicators by a variable in an index. But to be unidimensional, the indicators used should measure the same thing. If the questions are multidimensional then the measuring precision is not improved by the indicators being summed up in an index.

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